

Longest-Edge Refinement and Derefinement System and Method for Automatic Mesh Generation

Abstract

A method, mesh data structure and apparatus is disclosed for producing an improved / refined (240)/ derefined mesh (1300) of finite elements for a three-dimensional object showing boundaries and faces (200). The improvement / refinement method repeatedly searching (240), for consecutive sets of active target elements (210) to be refined or improved, an associated submesh and set of terminal edges (460), the searching process not modifying the mesh data structure; then according to the point insertion method chosen (220), selection of the point or the points to be inserted (240) between the midpoints of the terminal edges (510, 520) modified by some boundary considerations (780); inserting the selected point or points in the initial mesh (560, 570); and then proceeding to the succeeding set of active target elements (270) until an user-defined stopping criterion is achieved. The derefinement method, for each target vertex (1200) finding an associated set of neighbor vertices (1240) to be derefined; then

eliminating each said vertex (1280) according an appropriate order (1260) such that the derefinement of said vertex allows to re-obtain a previous terminal edge whose bisection produced said vertex. The method, mesh data structure and apparatus of this invention allowing the parallel scalable refinement (1100, 1150)/derefinement (1600, 1650) of the mesh by locally modifying sets of neighbor elements sharing the common longest-edge (1020, 1060, 1750).